

What is claimed is:

1. A method of manufacturing a semiconductor device having a plurality of gate insulating films of different thicknesses on a semiconductor substrate, comprising the
5 steps of:

injecting fluorine into a region of a semiconductor substrate other than a region of the semiconductor substrate where a thinnest gate insulating film is to be formed, among a plurality of regions where gate insulating films are to be
10 formed;

oxidizing the semiconductor substrate with fluorine injected therein to form an oxide film in said plurality of regions; and

nitriding a surface of said oxide film to turn a
15 surface layer thereof into an oxynitride film or form a nitride film on the surface of said oxide film.

2. A method according to claim 1, wherein said step of injecting fluorine comprises the step of:

20 setting conditions for injecting fluorine such that the gate insulating films formed on said semiconductor substrate have a thickness of at least 0.2 nm.

3. A method according to claim 1, wherein said step
25 of nitriding the surface of said oxide film further comprises the step of:

introducing radical nitrogen excited by plasma into the surface of said oxide film.

4. A method of manufacturing a semiconductor device
5 having a plurality of gate insulating films of different thicknesses on a semiconductor substrate, comprising the steps of:

forming a first oxide film on a surface of a semiconductor substrate;

10 removing said first oxide film from regions of the semiconductor substrate other than a region of the semiconductor substrate where a thickest gate insulating film is to be formed, among a plurality of regions where gate insulating films are to be formed;

15 injecting fluorine into the region other than the region where a thinnest gate insulating film is to be formed, among the regions of the semiconductor substrate from which said first oxide film has been removed;

oxidizing the semiconductor substrate with
20 fluorine injected therein to form a second oxide film in said plurality of regions; and

nitriding a surface of said second oxide film to turn a surface layer thereof into an oxynitride film or form a nitride film on the surface of said second oxide film.

25

5. A method according to claim 4, wherein said step

of injecting fluorine comprises the step of:

setting conditions for injecting fluorine such that the gate insulating films formed on said semiconductor substrate have a thickness of at least 0.2 nm.

5

6. A method according to claim 4, wherein said step of nitriding the surface of said second oxide film further comprises the step of:

introducing radical nitrogen excited by plasma into the surface of said second oxide film.

10

7. A method of manufacturing a semiconductor device having a plurality of gate insulating films of different thicknesses on a semiconductor substrate, comprising the steps of:

15

forming a first oxide film on a surface of a semiconductor substrate;

forming a first polysilicon film on a surface of said first oxide film;

20

removing said first polysilicon film and said first oxide film from regions of the semiconductor substrate other than a region of the semiconductor substrate where a thickest gate insulating film is to be formed, among a plurality of regions where gate insulating films are to be formed;

25

injecting fluorine into the region other than the region where a thinnest gate insulating film is to be formed,

among the regions of the semiconductor substrate from which said first polysilicon film and said first oxide film have been removed;

oxidizing the semiconductor substrate with
5 fluorine injected therein to form a second oxide film in said plurality of regions;

nitriding a surface of said second oxide film to turn a surface layer thereof into an oxynitride film or form a nitride film on the surface of said second oxide film;

10 forming a second polysilicon film on a surface of said oxynitride film or a surface of said nitride film; and

removing a structure above said first polysilicon film from the region where the thickest gate insulating film is to be formed, among said plurality of regions.

15

8. A method according to claim 7, wherein said step of injecting fluorine comprises the step of:

setting conditions for injecting fluorine such that the gate insulating films formed on said semiconductor
20 substrate have a thickness of at least 0.2 nm.

9. A method according to claim 7, wherein said step of nitriding the surface of said second oxide film further comprises the step of:

25 introducing radical nitrogen excited by plasma into the surface of said oxide film.

10. A semiconductor device having a plurality of gate insulating films of different thicknesses including at least an oxide film on a surface of a semiconductor substrate,

5 comprising:

a semiconductor substrate;

a plurality of oxide films formed respectively in different regions in a surface of said semiconductor substrate to respective different thicknesses; and

10 a plurality of oxynitride films or nitride films, produced by nitriding surfaces of said oxide films.

11. A semiconductor device according to claim 10, wherein said oxynitride films or nitride films are formed on
15 the surfaces of the oxide films other than the thickest oxide film.

12. A semiconductor device according to claim 10, wherein the thicknesses of said oxide films are different from
20 each other by at least 0.2 nm.